MASTER'S THESIS
TURKU UNIVERSITY OF APPLIED SCIENCES
SERVICE DESIGN
2017

SANNA KANGAS

SMART INSTALLATIONS

Mobile Application as a Platform for the Physical Installation Process of a Waste Sensor

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Mobile Application as a Platform for the Physical Installation Process of a Waste Sensor

The thesis focused on the installation process of the commissioner company's waste sensor and its user flow. A key feature in the installation process is the mobile application, which helps the installer perform the physical mounting and map the sensor to the system.

The study was conducted with qualitative methods, and the design process was conducted with service design methods suitable for the subject.

The outcome was a description of the new user flow and a mock-up of how the manuals should be implemented to the new mobile application. The thesis acted as a project description for the first phase of developing the application and was made simultaneously with the actual project within the commissioner company. The client will later decide how to proceed with the project and the outcomes of the thesis.

This public version of the thesis does not contain all the confidential material which is presented in the original document.

KEYWORDS:

Service Design, User Flow, Experience Design, User Experience

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LIST OF ABBREVIATIONS

O3	One-on-one interview. Type of interview which is conducted preferably face-to-face, but can be also conducted via phone or a conference call system (Usability.gov 2017).
UI	User Interface. The junction between a user and a computer program. The user interface is the part of the system that the user can interact with (Lauesen 2005, 1).
UX	User Experience. Design of the usage of a product or software. User experience encompasses all aspects of the end-user's interaction with the company, its services, and its products (The NNGroup 2017).
IoT	Internet of Things means internet-enabled devices, such as mobile phones, computers and tablets, but also fridges, washing machines and medical devices, existing as a part of the internet, relaying information back to the user but also to each other (TechWorld 2017).

1 INTRODUCTION

"*Waste management is considered one of the least sexy businesses on this planet*" is a common saying amongst the commissioner company's personnel. The argument is true since the entire human history waste has been seen as a non-desired material. However, as the humanity has recently discovered, the natural resources are not endless and thus recycling waste has become more important and waste itself a valuable resource. This is the commissioner company's mission; to make all waste a valuable resource. Waste is a global issue, and for example in the European Union alone a single citizen uses 16 tonnes of material per year, of which 6 tonnes becomes waste (The European Commission 2017).

The commissioner company of the thesis offers its customers a service to optimize waste collection. The commissioner's service consists of two components; the physical sensor, which measures the fill-levels inside a waste container, and the software, which transforms the data sent by the sensor into readable and understandable information. As installing a sensor to a container is where the whole process really begins, it is crucial the sensor is installed correctly. If not, the customer cannot have the data of the container fill-levels and thus the route optimization cannot be completed and the commissioner's mission cannot be executed. The sensor is a tool with which the commissioner's software can calculate the optimal emptying times and routes with a special algorithm. Along with a correct physical installation, the mapping of the sensor to the server is crucially important, in which the user participates by providing exact information of the container.

To keep up with the technical development, the commissioner company has placed effort in building a mobile application to cover the paperwork completed during the installation. However, the implementation of the first version of the application was insufficient and thus there was a need to rebuild the application based on user needs.

Before the commissioner's application all instruction materials, such as guides and how-to's, were delivered to the customer on paper. This was problematic since paper does not notify the customer if they leave a column unfilled, and because transforming the data from the paper to the system is a time-consuming process for both the customer and for the commissioner.

The commissioner wanted to develop the application by adding user value with better user experience, so this project had a clear goal and an actual need. In short, the aim of the thesis was to form an understanding of the installation process flow and concept an idea on how the installation instructions could be attached as a part of the new mobile application. The benefit was that the user could complete the installation quickly and efficiently, and the commissioner would save money and time as the customers would need less technical support.

The installation was considered as a pain point for both the customers as well as for the commissioner; customers felt the instructions of the installation process were unclear. The commissioner constantly received feedback from the field and from the installers stating that the instructions were difficult to read and understand, and the form in which they were delivered was not the best solution for outdoor use.

The issues with the instruction materials made the correct installation of the sensor at first try considerably difficult. From the commissioner's point of view the customer issues burdened the commissioner's support team and created additional costs. It had also been made apparent that installing sensors falsely caused issues to the sensor mechanics and at worst ended up breaking the sensor. Overall the user flow in the process was insufficient which concerned the commissioner as it wanted to serve its customers in the best way it could. From the user point of view not being able to install a sensor, or having to return to the site to fix an error in the installation, was taking considerable amount of the installers' time and nerves. The customer companies were also not too pleased with the poor user flow of the process.

In the first discussions with the commissioner's team members it became clear that within the commissioner company there was no clear vision on how the installation process should be designed for it to have a good flow. Different teams were familiar with only certain parts of the process and the overall picture was missing. Thus, understanding of the whole installation process was needed, from the physical sensor installation to the mapping to the server and usage of the mobile application. Understanding the old mobile application processes was also needed and what had been done so far and why. Based on the discussions with the mobile application development team which were held before the project kick-start, it became clear that there was no unambiguous understanding what the company wanted to accomplish with the application.

The greatest issue in the project was how the instructions should be added to the new mobile application so, that most of the installers would be willing to read them. As understanding the instructions, let alone reading them in the first place, is one of the most important things an installer must do, the instructions had to be designed to be appealing, easy to use and not too complicated. The task was difficult since the issue with manuals is that very few people are willing to read them, as they tend to be dull and boring. The mobile application development team had already tried text based instructions and an instructional video, but both options had been considered insufficient. Another twist to the project was created when it was decided that the new mobile application would be based on the old application. This resulted in the project having a legacy, which narrowed the options in the UI design and the data method.

2 WASTE MANAGEMENT

Waste management includes all the activities and actions required to manage waste; collection, transport, treatment and disposal. In the Western countries, the waste management is highly regulated by laws which differ depending on the country or area. For example, the European Union aims at stimulating innovation in recycling with targets set in the European legislation. This means that the European Union aims at lifting its recycling rate by reducing the amount of waste generated, maximising recycling and re-use, limiting the incineration to non-recyclable materials, gradually phasing out landfills to non-recyclable and non-recoverable waste and ensuring all Member States act according to the European Union waste policy (The European Commission 2017). The commissioner company operates mainly in the European Union and the United States, which act under each area's environmental laws. In the European Union, there is the 7th Environment Action Programme (EAP), which currently addresses the year 2020 (The European Union Environment Action Programme 2017). In the United States, there is the National Environmental Policy Act (NEPA) (The National Environment Policy Act 2017).

3 THE COMMISSIONER COMPANY

"*The company is a Finland-based waste management company established in 2010. It aims in transforming the financial, environmental and social impacts of waste. By collecting and analysing data from refuse containers across the world, the company can create efficiencies and cut the cost of waste collection and incentivise recycling. The company simplifies, de-risks and optimises the waste management process, helping to make a sustainable waste-free environment a more achievable proposition. The company is a global actor*." (Commissioner media kit 2016)

The commissioner's policy is that it does not only sell sensors, but it sells a service; a service with which the customer can optimize its functions and thus save money and the environment. The physical sensor is not the single thing the company sells, but a part of a solution. The company sells its solution to companies, which act in the field of waste logistics.

The commissioner company helps its customer companies to:

- **discover insights** in operations through monitoring the fill-levels of containers and the status of field operations
- **predict** the future service needs
- **optimize** the operations by automatically generating demand-based schedules, optimised collection routes and intelligence of customer operations (Commissioner Product Offering PowerPoint)

When a company buys the commissioner company's solution it receives sensors and installation tools and instructions, training to use the software and a support service. Additionally, if the company wishes so, it can have other premium services.

Basically, what this means is that by using the commissioner's service a waste logistic company can optimise its waste truck routes based on the data provided by the sensors installed in the company's waste containers. Optimising the routes means savings in time, money and personnel costs, lower gas expenses and CO2 emissions. It is not uncommon that by using the commissioner's service a company can cut the number of its waste trucks and thus save a considerable amount of money. With the commissioner's service the customer can for example:

- Maximize truck load at dump
- Minimize kilometers driven
- Minimize working hours
- Maximize the fill-level at collection
- Minimize the amount of overfill situations (Commissioner's Product Offering PowerPoint 2017).

The commissioner's service consists of two things; the physical sensor and the cloud-based software. The physical sensor is installed to the waste container and it measures the container's fill-level. The sensor then sends the data to the cloud-based service where it is analysed, and transformed into graphs and columns which the user can view. There are two crucial things which must be completed correctly for the system to function; the correct installation of the sensor and the correct mapping of the sensor to the system. The actual mapping is completed by the commissioner so the physical installation and delivering accurate data of the installation are the most important steps the installer must do.

Recently the commissioner has decided to take a more user-oriented approach when designing products and services. The thesis process thus has a good opportunity in helping the commissioner in its mission towards a more customer-oriented service. For the commissioner the user-oriented approach means participating installers and relevant personnel in the project, and using service design methods to observe the process.

3.1 Company Mission

The commissioner's company mission is to transform the financial, environmental and social impact of waste. The commissioner helps its customers by collecting and analysing data from refuse containers, and thus create efficiencies and cut costs of waste collection (Personal communications 2016).

The company brand is built around the service it offers. Visually the commissioner's brand is playful but not childish, colourful but not unorganized. The commissioner's brand has five main colours, has defined fonts and a tone of voice. The commissioner uses real-life photos of users using its service and video footages, and graphics with distinctive feel in all kinds of internal and external materials to brighten up the message.

3.2 Company Structure

The company consists of different teams and functions, from which the sales team is responsible for customer leads and first contacts. The sales team works closely together with the marketing team, which is responsible for the commissioner's visibility in exhibitions and in the media. When the customer has been onboarded, the project is handed over to the delivery team. The delivery team together with the support team ensures the customer is trained to the process, and sensors and accessories are shipped to the customer's locations. After successful installations, the support team takes the project from the delivery team. All the process is supervised by the product management team.

3.3 Installation Process

The installation process contains multiple steps, of which most are related to the physical mounting of the sensor. In the thesis, the installation process refers to the physical installation process, where the physical sensor is attached to the container. The overall installation process includes user training in understanding the system and process, understanding the physical mounting of the sensor and using of the software. The process is different for different user personas in the customer company depending on the size and structure of the company; in larger companies, every operation has a separate person or persons to execute it, but in smaller companies the same person may have multiple hats and must do everything by himself from being the overall handyman, sales person and the CEO of the company (Personal communications 2016).

As mentioned, in the thesis the installation process refers to the physical installation process of the commissioner's waste sensor. The physical installation process has eight steps;

1) Receiving the sensors and checking the shipment has everything needed in it,
2) Getting to know the sensor mechanics, understanding how it works and what tools are needed,
3) Receiving site map and locations,
4) Driving to the site,
5) Activating sensors,
6) Conducting an installation,
7) Checking the sensor is installed correctly and it connects to the network
8) Reporting the installation to the supervising person (Personal communications 2016).

3.4 Personas

The commissioner had defined a single user persona for the mobile application before the author joined the project. The persona was what was considered an average sensor installer:

“User persona: Jesse, a 58-years-old handyman from Dallas, Texas
Description: Jesse may or may not be an existing smart phone user but he is open to learning to use new tools and technologies. Like most handymen, Jesse is eager to get things done and sometimes takes shortcuts with measurements, configurations, screws and so on, so he can be more effective when he feels that "fewer bolts" would do the job just the same. Jesse has had an onsite training that has included one hour of instructions and practice with the use of the mobile application, but it has been a year since his last installations”. (Commissioner project definition 2016)

The main information from the persona is that the old mobile application was intended to be designed to a new user, not a heavy user. The commissioner had defined another user persona but it was put aside in the first phase of the project due to timetable issues. This other persona was considered a heavy user, a person who uses the application daily or weekly, and is familiar with the process. The reason why the heavy-user persona was left out of the first version of the new application was because the associates and commissioner’s customers on the field reported that most of the installers were new to the process, and would not benefit from heavy-user flows. The difference between a heavy-user and a new user is that a heavy-user knows the process by heart and can skip instructional sequences when using the application, whereas the new user does not know the process flow of the installation and needs more instructions of how to use the application. Assuming these two user personas can use the same flow would end up in the new user feeling confused and not knowing what to do, and in the worst case he could install the sensor incorrectly, whereas the heavy-user would become frustrated of the slow flow of the process.

3.5 Process Legacy

The installation process being a sum of different actions created at least somewhat independently, it is clear that the process has a legacy. All in all, the mounting process must be completed properly and because of this the commissioner wants to have the installation instructions as a part of the new mobile application to prevent mis-installations, user frustration and excessive workload of the support team. The legacy comes from the different parts of the process:

- The sensor; sensor mechanics affect the sensor's user interface and activation sequence
- Company mission; the company mission impacts the product range and the installation process as a product, and also defines which parts of the installation the company wants to emphasize
- Company structure; what kind of team structure the company has and how responsibilities are shared

3.5.1 The Sensor

The current sensor was designed in 2010 and the outer aspects (visual and user interface-related aspects) were affected by the aspiration towards physical endurance and molding technique restrictions (no sharp edges, shape preferably solid of revolution, no negative angles). The current sensor's form and mechanics affects the physical installation process so, that the sensor must be installed correctly. The most important thing in installing the sensor is its position in the container; the sensor must be placed correctly and the correct position varies depending on the container model. The sensor can also be installed using a bracket, which is a bended metal plate specifically designed for the purpose. The installer must drill holes to the container which can be

made of either plastic or metal, with the wall thickness of up to 10mm. The process requires special tools and the correct aligning of the holes, otherwise the sensor will not attach firmly and falls off in the worst case. The installer must also understand the functions of the sensor to be able to install it correctly (Personal communications 2015).

The installation tools also impact the experience the user receives from the physical installation process. The tools are specifically designed and made to help the installer mount the sensor. The tool set consists of an installation plate, an activation tool and a special installation tool.

3.5.2 Mobile Application legacy

The mobile application is primarily an installation aid tool for the installer on the field. It is used outdoors and thus the installer has to be able to use it in all weather conditions and with gloves on. The mobile application is used during the physical installation of the sensor and is used to guide the installer through the installation process and to map the sensor to the system. With the application the installer has to be able to install the sensor successfully, to remove the sensor or replace a sensor. Cases where the sensor needs to be removed are if, for example, the sensor has stopped working or the installer wants to relocate the sensor to another container. Other functions have been discussed within the commissioner, such as seeing a list of installed sensors, but these are more advanced functions and are not current in the first version of the new mobile application.

4 RESEARCH PROCESS

4.1 Research Subject

The research was conducted within waste management business, and within the frame that the commissioner set up for this project; the commissioner wanted to develop the mobile application so that it would better meet the user needs. What these needs were specifically was studied in the first phase of the research process.

The research was divided into sections. The first phase was divided into two sections; the internal studies and the external studies. The idea was to verify the findings from both sections from two perspectives: within the commissioner company and outside the commissioner company. The goal of the internal studies was to create a wireframe of the installation flow, determine pain points and form an understanding of the old mobile application legacy. The goal of the external studies was to confirm the correctness of the installation flow journey and validate pain points.

The research took place among relevant stakeholders who participate in the commissioner's customer-related and installation-related processes. These stakeholders were divided into two groups; people who work for the commissioner company (*internal studies*) and people who work for the commissioner's customer companies (*external studies*). Service design methods were chosen to best suit the purpose; "One-On-One" interviews (O3's), a brief workshop, brainstormings and analysis of the old application were used in internal studies, and in external studies information was gathered by observation and rapid interviews. Desk research with literature and internet sources supported the gathered information and formed a theoretical basis for the study. Customer journey mapping was used as a tool when the process was mapped.

The internal studies started with interviews for the commissioner company's employees and was conducted with the "One-On-One" interview method. The O3 method is a face-to-face interview between the researcher and one participant (Curedale 2013, 186). These interviews were conducted with stakeholders within the commissioner company, who had an understanding and experience of installations and/or customer feedback. The O3-method was chosen to gather information as widely as possible since O3's tend to provide different information from a workshop or brainstorming due to its nature. In O3's the gathered information was more personal than the information gathered in a workshop or in brainstorming sessions. In the workshop the aim was to gather **directions**, **processes** and **methods**, whereas in O3's the aim was to gather **opinions**, **feelings** and **personal experiences**. Brainstorming sessions aimed at observing the current solution and ideating new solutions based on it.

The brief one-hour workshop determined the basic issues of usability and pain points of the old mobile applicaion. This workshop was called mainly to activate the team to take a stand working with the task, and function as a retrospective for the old mobile application.

The external studies were conducted with the observation method and the rapid interview -method, both conducted during installations. The idea of the external studies was to have concrete examples of the findings from the internal studies, and verify that the findings were correct. Thus, the goal of the external studies was to confirm the correctness of the installation flow journey and validate pain points. The external studies focused mainly on usability. Usability here means how efficient and satisfying from the user's point of view the interaction was (Keinonen 2000, 9).

After the first phase was completed it was possible to make a summary of the findings and form a valid installation flow journey, which included an understanding of the installation process and the pain points, and understanding of the old mobile application legacy.

Literature and Internet sources were studied to form the theoretical part of the thesis. The desk research covered experience design, as the installation process is seen as an experience within the commissioner company.

In the fourth phase a user journey map of the installation process was made based on the summary of the first phase. The journey map described the flow of the mobile application during installation. Based on the map the agile development process was completed and a concept of the user flow in the mobile application. This concept was the outcome of this project and later used by the commissioner to develop the new mobile application.

4.2 Research Questions

Two research questions guided the process:

1. **Why do the physical installation instructions of the commissioner's waste sensor need to be added to the mobile application and how does this benefit the user?**

2. **How should the installation materials be designed and implemented to the new mobile application so that the user benefits from them as much as possible?**

The research questions were formed to best support the aspiration towards better usability and user-friendliness of the commissioner's sensor installation process. The first question defined the functions of the old mobile application and why the installation instructions needed to play a more visible part in the new mobile application. The first

question also defined the current user journey of the installation conducted by the user, and how adding the instructions as a part of the new mobile application would make a difference to the user compared to a situation where the instructions were printed on paper.

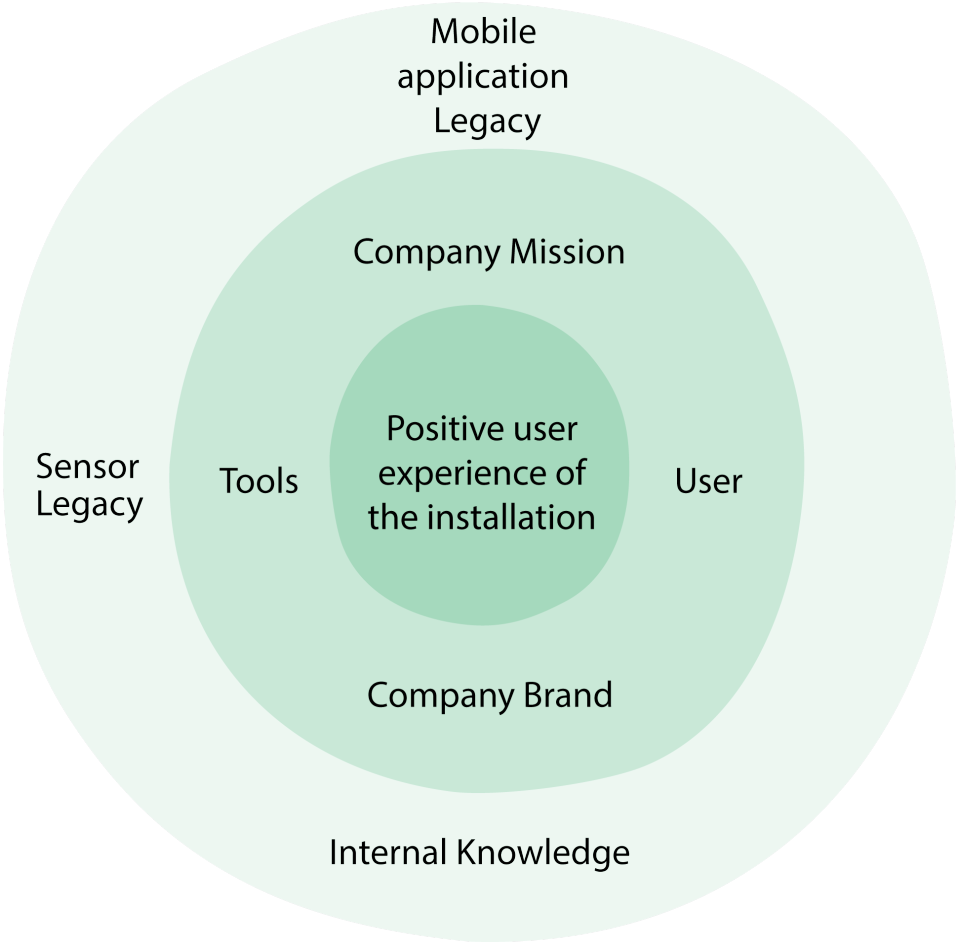
The second question was about designing the new mobile application and how the installation manuals and instructions could be added as a part of the application, so that the user would benefit the most from them when keeping in mind the existing specifications of, for example, the sensor mechanics.

4.3 Frame of Reference

The frame of reference was built around the theme of the thesis, the user-friendliness and positive flow of installing the commissioner's waste sensor. **Picture 1** describes the reference frame, which has three levels, the core of the process being the positive user experience of the installation. The positive user experience of the installation is the core goal of the process and what was considered a positive experience and how it reflects with the subject is described in Chapter 5.

On the second rim there are points which impacted the process in the first place; the commissioner's mission and brand, and the user. Everything done within the commissioner company is dictated by the company mission and brand guidelines, and therefore it also impacted the thesis. The user is naturally in the reference frame, as it is the user who the commissioner is aiming at helping with its service. The installation tools naturally impact the flow of the installation process, which is why also they need to be redesigned at some point in the future. The tool design was left out of scope of the thesis as the main focus was on the new mobile application.

On the outer rim there are points which impacted the process at the background. These were the old mobile application legacy, sensor legacy and internal knowledge. Legacy meant that the project was based on an old project, which meant there were some restrictions in the data model. Internal knowledge affected the project since as the commissioner is building something completely new with its waste optimization, basically everything done within the company is invented from the very beginning. Though the commissioner does take pieces and ideas from here and there to build its service, it is, however, the internal knowledge which defines what and who the commissioner is as a company and what kind of solutions it offers. The commissioner learns as it goes so it is justified to say that internal knowledge plays a great part in solution-building and brand-forming.

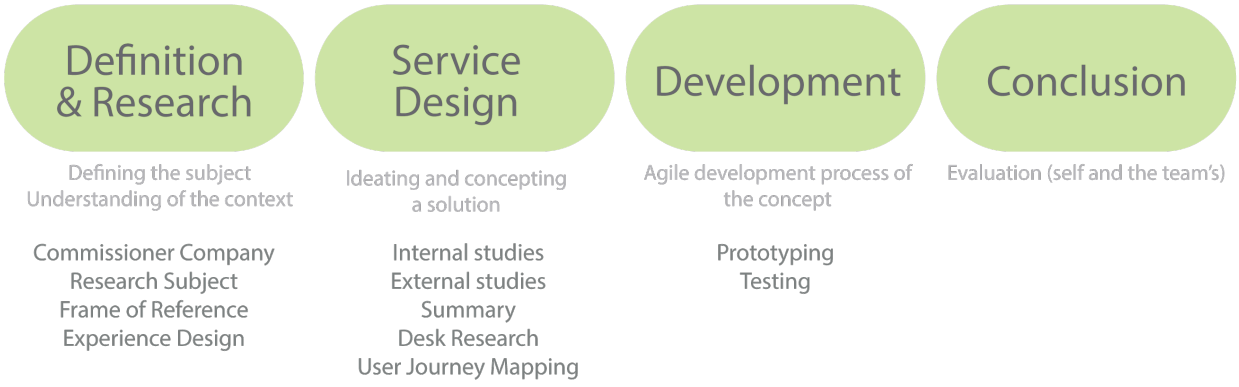


Picture 1: Reference Frame. In the center is the core aim of the thesis, around which are the things affecting the process in two layers (Kangas 2017)

4.4 Thesis Process

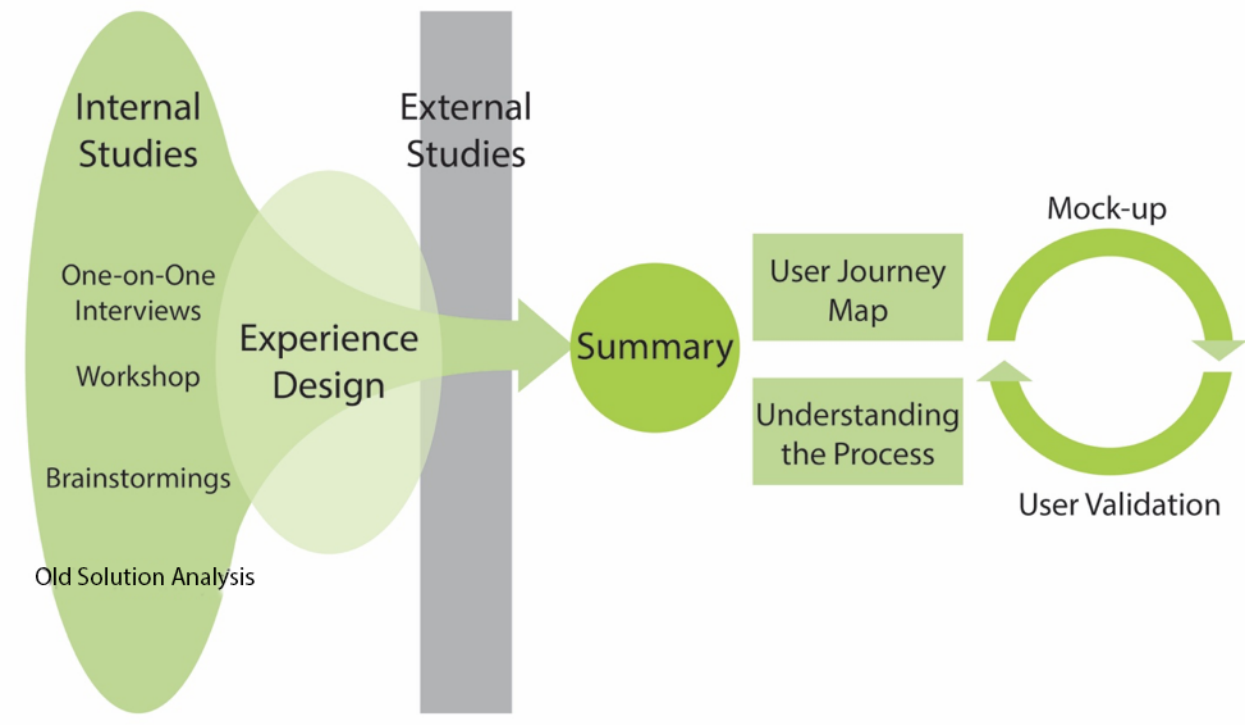
The thesis process was divided into four sections; the **Definition & Research** phase, the **Service Design** phase, the **Development** phase and the **Conclusion** phase. Each phase was divided into sections as described in **Picture 2**. Each section was finalised before the next section could begin. The sections were linked and supported each other, and formed a dialogue.

The “Definition & Research” –phase included defining the commissioner as a company and its brand, where the company intranet was a great resource. The “Research Subject” was defined together with the commissioner representatives and formed to be the development of the new mobile application due to its critical status in both customer satisfaction and certainty of installations. The “Frame of Reference” formed from the research subject and “Experience Design” was chosen to be the subject of theoretical studies since the installation process was seen both as a service and an experience.



Picture 2: Thesis Process. The project started with defining the subject and conducting research, after which comes the service design -phase and development -phase. After the development, there was the conclusion -phase (Kangas 2017)

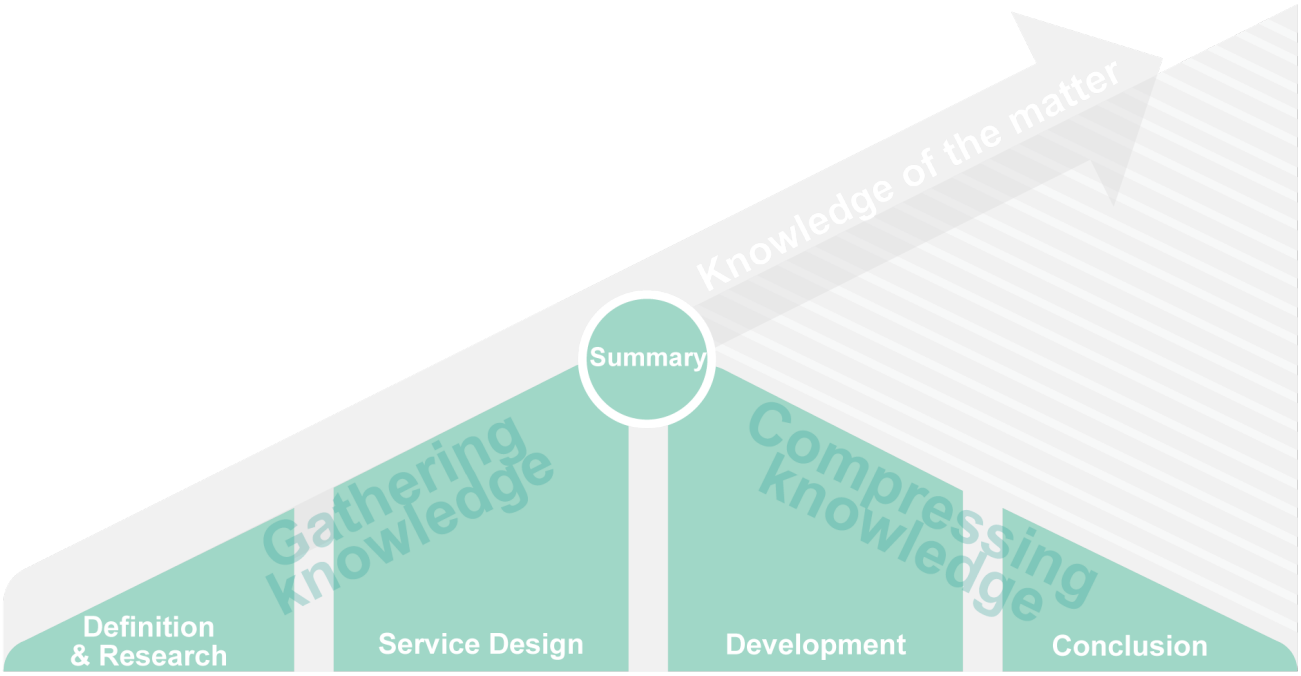
The “Service Design” -phase was divided into two sections, the internal studies and the external studies. The external studies acted as a gateway to ensure the information gathered during internal studies was correct (**Picture 3**). The summary was the outcome of the research process, after which the user journey map and understanding of the process formed. The “Development” –phase included prototyping through agile development process together with the software team.



Picture 3: Thesis structure. The internal studies prior the experience design, which acted as the theoretical base for the project. The external studies verified the correctness of the information gathered, and acted as a control gate before the summary. After the summary, a user journey map was created and an overall understanding of the process was acknowledged. The project then formed a looping structure with mock-up building and user validations (Kangas 2017).

The knowledge gathering process is described in **Picture 4**, the structure of which is based on the double diamond -method by Design Council. The “Definition & Research” -

phase together with the “Service Design” -phase are the part of the process where information is gathered. The part concludes with a summary of the gathered information, and is compressed to a solution in the “Development” and “Conclusion” -phases. The overall information of the matter is incremental through the whole process.



Picture 4: Process knowledge. Based on the Design Council’s “Double Diamond” –standard, the process knowledge chart shows the process visualised (Kangas 2017)

4.5 Methods

As the installation process is based on communication and understanding the user situation and needs, the methods were chosen to be qualitative instead of quantitative. Most of the information was held by the commissioner company’s employees and management, but it had to be made available so that it could be utilized. As the

information was already there, but it had to be gathered and processed, methods were chosen to support this aspiration. The internal studies aimed at answering questions “Why”, “How”, “Who” and “When”, and the external studies aimed at verifying that these findings were correct. As described in **Picture 7**, the process formed a flow and its last phase was looping, giving it the possibility to develop the outcome as long as the commissioner wishes to.

4.6 Known Information

It is not always known who completes the sensor installation, which creates challenges in planning the tools and processes for the installation flow (Personal communications 2016). The single user persona explained in Chapter 3.3 is the only defined user persona and assumed to be the most accurate description of the person who completes the installations. The commissioner assumes that most of the installers are unfamiliar with the sensor and thus the mobile application user flow has to be designed so that it is simple and easy to understand even without previous experience of the subject. The installer has in all cases received training, but the commissioner cannot always verify how thorough the training has been or if all the installation-related matters have been covered.

The commissioner assumes the following:

- The installer has completed a training **but the commissioner cannot ensure the quality of the training**
- The installer has completed a training **but might have forgotten most of the things taught by the time he completes his first installation**
- The installer has seen the sensor and the installation tools before **but does not necessary know all the details**
- The installer knows how to use a smartphone **but might not be a power user**

5 EXPERIENCE DESIGN

"*Experience design is practice focused on human outcomes, in particular the level of engagement and satisfaction that the user derives from a product or service and the relevance of the experience to their needs and context.*" (Foolproof 2017).

Experience design was taken as a part of the thesis because previously almost all the commissioner company's actions had been based on engineering thinking. With the solutions presented in this thesis the aim was to give the commissioner an example how its solution could benefit from design thinking. As the commissioner company is not a sensor company, but a service company, it was justifiable to assume that it would benefit from taking service design methods as a part of its processes.

In the center of the process was the positive experience of the user when installing a sensor. In the Longman Dictionary "*being positive*" is defined as following: "*if you are positive about things, you are hopeful and confident, and think about what is good in a situation rather than what is bad.*" (Longman Dictionary of Contemporary English Online 2017). Based on this definition it could be said that the positivity in the installation process should come from confidence towards the process (assumption 1: the process will work as promised), confidence from within the installer himself (assumption 2: previous positive experiences, "I know how to do this"), trust towards the system (assumption 3: the system works as it should and does not cause issues or dangerous situations) and well-designed flow of things (assumption 4: focusing on what is good in the situation, or the task being "quick & easy" and not having to waste excessive amount of time and effort in it). It could also be said that since the installation had previously been a pain point, at least one of these things had failed and the installation process had not been a positive experience for the user.

These findings were important since they defined the good user experience in the installation process. The key points for a good user experience in the commissioner's waste sensor installation are thus:

1. The installation process is designed keeping user experience in mind so, that the user can perform an installation procedure correctly and in a reasonable amount of time without having to contact the commissioner's support team.
2. The installation process has been designed for the purpose and for the user. Tools and guides have been designed so, that the user can benefit from them as much as possible when performing an installation.
3. The process keeps the installer safe and does not cause dangerous situations.

Experience here means the user's experience when using the service, overall usability of a service and understandability of a service. The Harper Collins Dictionary defines experience as "*the knowledge or skill of an event, activity or subject gained through involvement in or exposure to it*" (The Harper Collins Dictionary Online 2017).

What comes to positive experiences, the author's personal view is that an experience defines as positive also if you do not have to give it too much thought, or while experiencing something it does not take all your focus and energy, but gives you a moment to enjoy the smoothness of a well-designed service. For example, if a ride in a lift has been successful you do not have to think about it too much and have time and energy to pay attention to other things, such as checking your phone or just taking a small moment to breath and gather your thoughts. But a ride in the lift is rarely a life-changing experience, something that changes the user's life, but more a way to transport from point A to point B. When talking about an experience here it does not refer to experiences like parachute jumping or swimming with the blue whale, but to a more everyday-life experiences designed to make the user's everyday life smoother and to allow the user to focus on other things.

Apart from personal views, there are a few different scientifically studied terms how to define an experience. At first the installation is a cognitive experience, as the user is new to the matter and has maybe never seen a sensor before. At this stage, the correct installation requires thinking and problem solving from the user. The easy-to-read manuals and guides play a significant part in this stage. After couple of installations the installation process becomes a subconscious experience, especially if the installer installs sensors daily. The subconscious experience is automatic; something the user does not have to think too much about, a routine. Also, if the installation process could be designed so easy that the user would not need to read instructions or participate training, it could be a subconscious experience. But as subconscious experiences are something easy, like using a hat, the sensor installation cannot really aim at being a subconscious experience. After installing couple of sensors, the process also becomes a storytelling experience, something the user has previous experience of and becomes personal and includes emotion (Seisto et al. 2013, 28).

5.1 User Experience

A pioneer in the field of user experience, the *Nielsen Norman Group*, defines user experience as a tool to meet the exact needs of the customer. User experience should guide all aspects of the end-user's interaction with the service provider and its service and products (The NNGroup 2017).

Even though the thesis contained both, user experience design (UX) and user interface design (UI), the impact of user experience design was more remarkable. In the thesis user experience means how the user (here: installer) is able to use and understands the principles of the mobile application so, that the outcome is a successful installation from both the installers perspective and from the commissioner company's perspective.

5.2 Usability

According to the *Nielsen Norman Group* (NNGroup), usability is a quality attribute, which assesses how easy a user interface is to understand and use. The NNGroup lists five points how usability can be measured (Learnability, Efficiency, Memorability, Errors and Satisfaction), but for this thesis the most important is the question "*Does it* (the service) *do what users need?"* (The NNGroup 2017).

From the perspective of the thesis, usability can be seen as a question whether the new mobile application succeeds in filling the needs of the installer; is the installer able to understand the logic of the application, does the installer find the application useful and does the application and the service it offers fit in to the installation moment? If the installer for a reason or other feels the application does nothing to help him, or even makes things difficult, there is a small chance the installer will like using the application, or even use it in the next installation at all.

6 SERVICE DESIGN

In the thesis service design refers to the theory and methods used when designing customer or human-centered solutions. The aim of service design in the thesis was to improve user experience of the commissioner company's new mobile application and make it feel more logical, desired, competitive and unique for the user. According to Satu Miettinen in her book *An Introduction to Industrial Service Design* is stated that service design is an approach for developing services that are immaterial and abstract (Miettinen 2017, 15). Thus the process of designing the commissioner's installation process was sort of a hybrid, since it contained both physical and non-physical matters.

6.1 Internal Studies

The internal studies focused on collecting opinions, feelings and personal experiences, as well as directions processes and methods. The process is described in **Table 1**, where the first section focused in gathering information about the current process through One-On-One interviews, brainstormings and a workshop. The second section defined the sensor legacy, mechanics and design, and the third section acted as the method for external studies to define the correctness of the internal studies.

The sales team's offsite acted as an interesting cross section of the installation process, sensor delivery and company mission. Several conversations with the sales team members addressing various matters and perspectives in the installation process were held during the two-day event. Due to the nature of these conversations they acted more as an indicator about the company structure, mission and values, as well as the installation process in general.

Current process
(what is done in different phases of the process, how, when, why etc.)

Date	Action
8.12.2015	O3 with a member from the Operations team
9.12.2015	O3 with a member from the Product Management team
4.1.2016	O3 with a client
5.1.2016	Brainstorming session 1/3
7.1.2016	O3 with a member from the Admin team
11.1.2016	O3 with a member from the Sales team
12.1.2016	Workshop
12.1.2016	O3 with members from the Sales and PM teams (3 persons)
18.1.2016	O3 with team members from the Sales team (2 persons)
19.1.2016	O3 with a team member from the Sales team
21.1.2016	O3 with a team member from the R&D team
21.1.2016	Brainstorming session 2/3
28.-29.1.2016	Sales team offsite
28.1.2016	O3 with a member from the Operations team
9.2.2016	O3 with a member from the Support team
9.2.2016	O3 with a member from the Operations team
10.2.2016	Brainstorming session 3/3

Sensor legacy, mechanics and design (why is it as it is, what things lead to the current design, known issues, reasons behind the design, how could it be improved)

Date	Action
8.12.2015	O3 with manufacturer
7.1.2016	O3 with members from the Admin team
20.1.2016	O3 with a member from the R&D team
25.1.2016	O3 with members from the R&D team

Installations

Date	Action
5.2.2016	Observing an installation done by Enevo employee
29.2.2016	Observing an installation done by client
1.3.2016	Conducting an installation

Table 1: Schedule for internal and external studies (Kangas 2017)

6.1.1 O3 Interviews

An O3 interview (also known as individual interview) is a method used to conduct a face-to-face interview. This kind of interview usually is 30 minutes to one hour in length. In O3 interview the subjects discussed are more personal than for example in a workshop or group interview. O3 interview allows to probe the attitudes, emotions, beliefs and experiences of the interviewed person, whereas a group interview or a workshop is more about group opinion (usability.gov).

The O3 interviews took place between December 2015 and February 2016 and the total number on of people interviewed was 20. The structure of the interviews was kept as light as possible, and it focused on the **opinions**, **feelings** and **personal experiences** of the interviewee. Notes were not taken during but right after the interview to be able to give the interviewee a full focus. Before the interviews, a loose frame of questions was outlined, which was followed depending on the person interviewed and his or her role and experience.

Frame of questions for the interviews:

- Has the person completed an installation (location, date, customer (or private), weather conditions, tools used)?
- Has the person watched someone else perform an installation?
- What are the main issues in the sensor installation?
- What are the most important matters when installing a sensor?
- Opinions of the installation tools; what is good/bad, has the person used the tools himself and in what kind of installations, opinions of the tools?
- Activation; easy or difficult, what is difficult, what is easy?
- Describing the installation process step by step?
- Gear used when completing an installation?
- Technical matters (if the person knows about them); mechanics, current structure and can it be changed?

- History of the sensor design, what has been done so far and why (if the person knows about it)

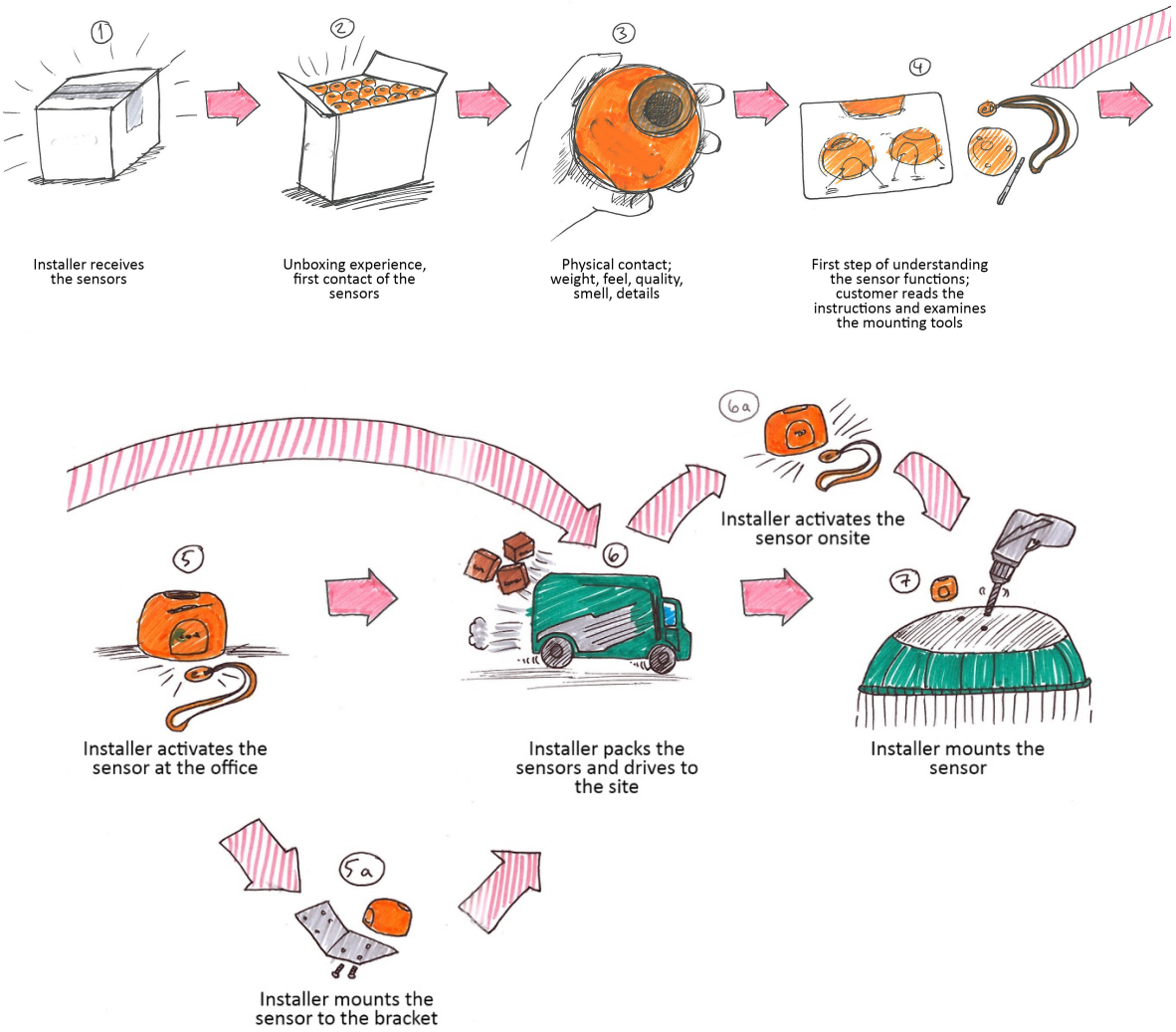
The result of the O3 interviews was a rough installation process journey (**Table 2**), which describes the physical installation process step by step and the tools needed. The process is divided into three sections; “Before going to the site”, “Getting to the site” and “At the site / Installation”.

Picture 5 presents the process visually. From the installer’s point of view the process begins with the sensor’s arriving to the office or warehouse. The next step for the installer is to check the shipment and examine the number of sensors is correct and that the sensors are as they should be, after which he is able to drive to the site and mount the sensors. The installer might want to activate the sensor at the office or at the site. If the installation requires a bracket, the installer has to attach the sensor to the bracket prior the installation, which can be done either at the office or at the site.
The O3’s also gave information about the pain points in the installation process and suggestions how they could be solved. The installation journey was later verified by observing both non-commissioner employee installers performing an installation and also the commissioner’s employees, who had not previously performed an installation, so that both experienced user feedback and non-experienced user feedback was gathered.

The process journey showed that the user needed the help of the installation manual at least in all "*C: At the site / Installation*" -actions and when activating the sensor (A1). The user also needed the mobile application in other actions which are marked in **Table 2**. As the old application had not been used by external customers, the users had been using just pen and paper to mark down serial numbers, installation times, site locations, and other information depending on the customer.

A) Before going to the site:	Tools needed
1. Installer activates the sensors at the office / other indoor location.	Magnet fob, activation guide
2. Installers exports the locations of the sites to Google Maps.	Mobile application
B) Getting to the site:	
1. Installer drives to the location.	
2. Installer locates the containers.	Mobile application
3. Installer parks the car next to the site or as close as possible.	
C) At the site / Installation:	
1. Installer walks to the container and checks the container's inner structures. Installer checks both sides of where the sensor will be mounted.	Flashlight, ladders
2. Installer takes necessary tools with him and checks the sensors are active before leaving the car.	Activation tool
3. Installer places the tools near the container and climbs on top of the container, if necessary.	Ladders
4. Installer drills the first hole using a drilling machine.	Power drill, drill bits
5. Installer aligns the template with the hole and places a screw driver (or other similar tool) through the hole, so the template stays still	Template tool
6. Installer drills the second and third hole.	Power drill, drill bits, template tool
7. Installer places the second sensor label on the inner surface of the container's lid.	
8. Installer either places the sensor underneath the drilled holes inside the container by reaching by hand or uses the [redacted]-tool: Installer inserts the [redacted]-tool to the sensor, pushes the tool through one of the holes from inside the container and places two bolts to the remaining holes using a drilling machine with torx bits. Installer then removes the [redacted]-tool and tightens all the bolts.	[redacted] tool, torx screws, torx bits, power drill
9. (Installer finishes tightening the bolts with the manual screw driver.)	
10. Installer returns to the car and marks down the installation time to the excel sheet.	Mobile application or pen&paper
11. Installer marks the sensor ID numbers to the excel sheet.	Mobile application or pen&paper

Table 2: Sensor installation process journey (Kangas 2017)



Picture 5: Visualisation of physical installation journey excluding site list (Kangas 2017)

The installation journey formed to be the following:

1) Understanding the matter: what is it that has to be done and how
2) Preparations before the installation: what tools are needed
3) Locating the site and driving to the site: finding the site and logistics
4) Checking the container: observing the structures and the site
5) Mounting the sensor: using the tools, safety matters

6.1.2 Workshop and Brainstormings

A workshop is a method commonly used in service design, since it brings participants together to work on a matter. The service design workshops are both collaborative and creative and are divided into four sections; “Understanding”, “Imagining”, “Designing” and “Creating”. In the “Understanding”-phase the goal is to understand and define the issue or matter at hand, in “Imagining” the goal is build service scenarios through service innovation or improvement. In “Designing”-phase the concept is moved towards a detailed view of the user experience from both views, the front-stage development and back-stage development. In the “Creating”-phase the project is seen as a part of the greater picture and from the perspective of business goals (Service Design for Business 2016, 177-178).

One brief workshop session and three brainstorming sessions took place during the internal studies. The brief workshop was held to the team working with the new mobile application consisting of ten members and was conducted by the team leader. The goal of the workshop was to find pain points of the old mobile application. The team was asked to create ideas and pin pain points in five sections; reliability, functionality, correctivity, simplicity and physicality.

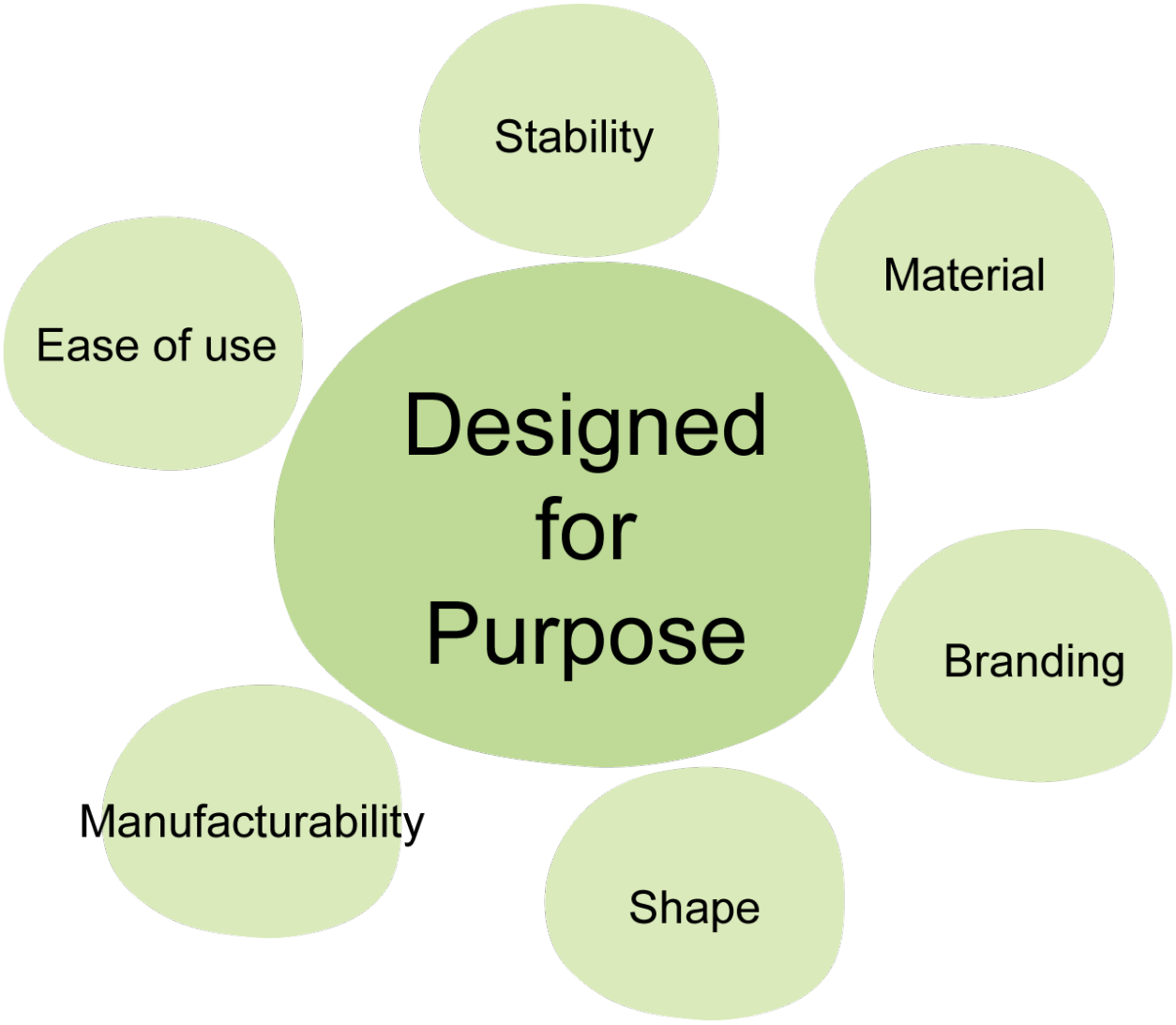
The key findings from the workshop stated mainly the lack of good user experience when using the application. The participants found the workflow of the application confusing and hard to understand, especially for people who are not familiar with the commissioner’s data model. User guides were hard to find and did not support the work flow. The logic of the application was found complicated and the application asked permission to perform functions too often. Other usability issues were also mentioned to be understanding and perceiving the application, such as identifying a container by just its name, without a photo, or finding the logout button.

Brainstorming is a method used to generate new types of solutions and perspectives to issues. Brainstorming allows each member to understand better the issue at hand, as the participants are usually allowed to bring up ideas freely (Curedale 2013, 262).

The brainstormings were held to a selected group inside the commissioner company, who had been working with the installation and the tools. The group consisted of seven individuals. The subject of the brainstormings was the physical installation process. Since the installation tools are the key part of a successful physical installation, it was agreed with the participants that the brainstorming sessions would focus on the installation tools and the participant's idea and experiences about them.

The first brainstorming started by explaining the issue, after which each participant was asked to write ideas and experiences of the installation process and the tools to Post-it notes. After five minutes had passed each participant was given five minutes to share his opinions, feelings and experiences, or to comment on those of others. The participants were asked to place the Post-it's to a whiteboard and after that the notes were grouped by subject. Thus, it was possible to identify six main points, which was agreed to fit under the theme, "Designed-for-Purpose", which was the keyword of the brainstorming session. The outcome of the session was a mind map (**Picture 6**). The other two brainstorming continued the subject and more deeper conversations were held.

Though the actual tool design was not a part of this thesis, the outcome from the brainstorming session clearly showed that every part of the installation process needed to be user friendly. And though **Picture 6** shows the outcome of the physical tool brainstorming session, it could be seen as the requirements for the whole process.



Picture 6: Brainstorming session mind map (Kangas 2017)

6.1.3 Analysis of the old Mobile Aplication

The commissioner decided that the new mobile application would be based on the old aplication. Thus, the analysis of the old application was relevant, since it gave an idea what had been done previously and what were the pain points. Discovering why the

application was difficult for the user to use was easy, since the whole customer journey of the product had not been given enough thought. It was also unclear what was it that the commissioner company tried to achieve with the application.

The user path of the old mobile application is as described in **Table 3** and **Picture 7** below.

Step n:o	**Task**	**Sub task**
Step 1	Log in	
Step 2	Container view: Create new site	Type in: Name, Address, Area, Type, Customer key
Step 3	Add container (by NFC/QR/manually)	Add: Container type, Serial number, Customer key
Step 4	Read guides	
Step 5	Add sensor (by NFC/QR/manually)	Sensor number

Table 3: Old mobile application step-by-step walkthrough (Kangas 2017)

One of the issues was that the installation process did not support consulting guides only but when the installer had clicked “Add sensor” and scanned the sensor ID label. Based on the observations of the old mobile application it was justifiable to suggested the installation guides to be presented differently so that they would be easily accessible.

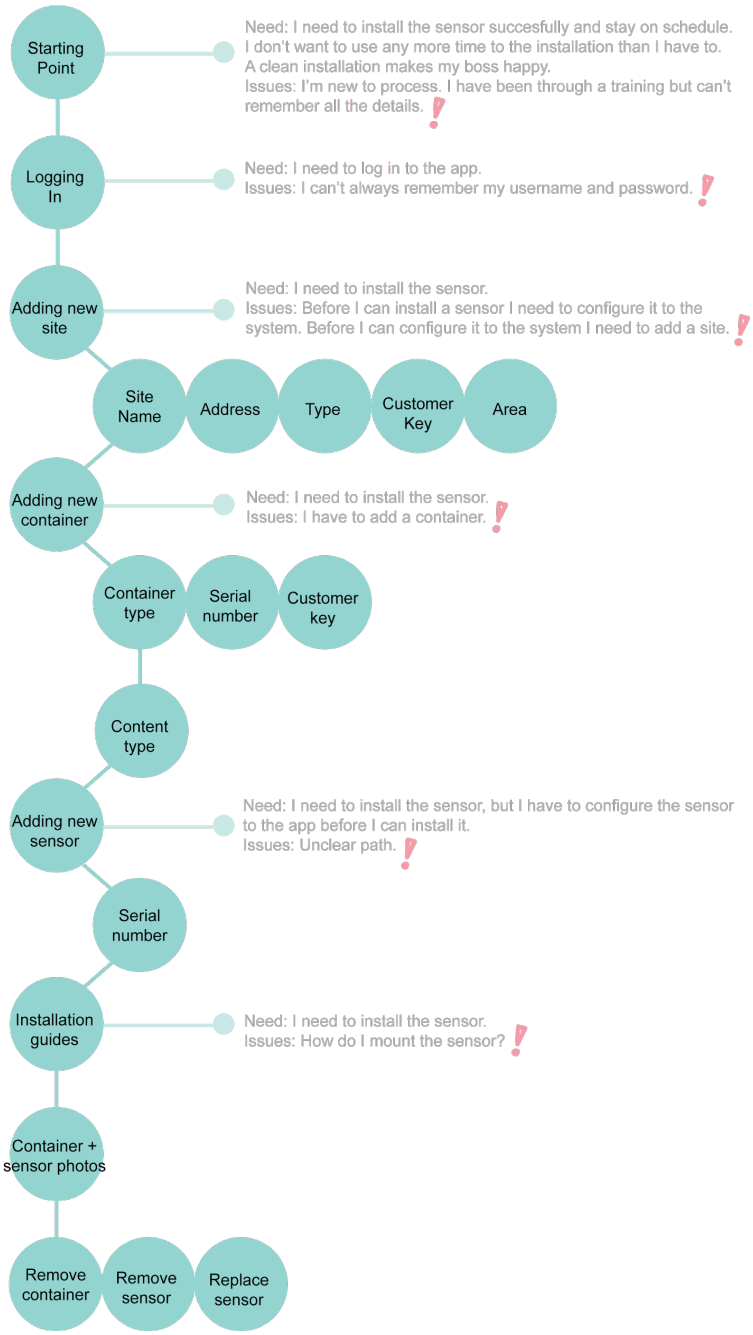
In **Picture 7** is described visually the old mobile application's flow. As it can be seen the flow is not smooth but has many issue points marked with red exclamation mark. The issues can be divided into three sections:

Human centered issues: Actions such as focusing, paying attention, remembering. Issues can occur if the person does not pay attention, is absent minded or unmotivated.
Example: Focusing during training session or remembering password. Reasons can be personal and the commissioner company's ability to affect these is minimal.
Solution: Difficult to impact on motivation-related issues or remembering. The commissioner company can only ensure the user flow is good and the materials given out are made for the purpose and the training held is easy to follow. But if the person does not want to read manuals there is very little the commissioner company can do.

Usability centered issues: Things such as good flow of the process, guiding the user through the process intuitively. Issues can occur if the process flow is too complicated, unclear or not made for the purpose.
Example: Why does the user has to first define Site, the Container and only after that, the Sensor, when the user's main goal is to install the sensor (his focus is in the Sensor, not in Site nor Container).
Solution: Defining the user path, defining the issues in it and improving them.

Technology centered issues: Things to do with the physical installation process, such as tools and gear, screw tightening moment, types of screws, sensor physics and design history.
Example: Process flow is not good because the sensor has not been designed keeping the user in mind.
Solution: To have all components of the process designed for the user.
Also issues to do with the usage of the technical device (phone/tablet), but to these the commissioner company cannot really do anything.

The human centered issues and technology centered issues were not considered in the thesis process, as it focused on usability issues. But as can be seen in **Picture 7**, the human centered issues and technical issues would both need attention in the future projects. Experience design methods could be used to improve the flow also in these matters.



Picture 7: Old mobile application step-by-step walkthrough (Kangas 2017)

6.2 External Studies

The external studies acted as a gateway to ensure the information collected during the internal studies was correct and accurate. The external studies were divided into two phases, which supported each other; the observing –phase and the rapid interviews –phase, which both took place between 2nd of February to 1st of March 2016. By the time of the external studies it was relatively cold time in Finland, which made the installations more difficult than usual, but gave a realistic perspective of the situation. Sometimes the actual installing moment happens under difficult weather conditions, and in those conditions the tools are difficult to use because the installer has to wear gloves, it might be raining or snowing, the wind might get a hold of smaller things such as bolts. Also surfaces can be slippery and containers covered in snow. In the opposite weather conditions, different things must be considered; the surfaces might be hot, the installer might suffer from dehydration and it might be difficult to get a hold of the tools due to sweating.

6.2.1 Observing

Observation was conducted during three different installation sessions between 5th of February to 1st of March 2016 (**Picture 8**). Before the installations, a list of questions was created which needed to be payed the most attention. But as it was soon discovered, the installation process is always a unique situation depending on the installer person and his or her previous experiences, so the list acted more as a guideline, not as the absolute truth.

- What kind of steps, and in what order, does the process have (what is the person doing first, secondly, thirdly etc.)?

- How smooth is the procedure (does the person have to repeat some steps)?
- Which objects the person examines closely, which not so closely?
- How the person understands the installation process and the tools?
- What kind of questions does the person have for every step?
- How the person uses the tools?
- What consumes most time?
- How long does it take to conduct an installation?

Also, things not directly related to the physical installation, such as “did the installers find the sites easily” and “did the installers understand the manuals unambiguously” were observed.

The findings from the observations were relatively unified. The steps followed the findings from Chapter 6.1.1. more or less, the only difference being the order in which the installer performed the steps.

Picture 8: Observing installations (Kangas 2017)

6.2.2 Rapid Interviews

Rapid interviews were conducted during the installations, together with the observations. The method was chosen because the installation moments tend to be hectic, so there was no time for a real interview, and opinions asked during the installation were more realistic than opinions asked afterwards. As the observation and rapid interview -methods were done side by side, they were clearly linked and supported each other.

In the rapid interviews, the focus was in the installer's current feelings and in the moment, not in what could be done differently or how the process could be developed. The feelings the installer had varied from frustration of something not working properly or as assumed, to satisfaction of things going surprisingly smoothly. Some of the installers used the old mobile application while performing the installation.

Findings from the rapid interviews:

- The tools do not always work properly (the customer company installer had developed his own installation tools)
- The site is sometimes difficult to find (the containers are not always where the map points they should be)
- The holes are difficult to align (tool design should be improved)
- The process flow is not always clear (what happens when and what steps are obligatory, how many steps are there)
- The tools are not designed keeping the purpose in mind (difficult to grasp, difficult to use)

6.3 Summary

The research clearly showed that the usability and user-friendliness aspects of the installation process needed streamlining. The answer to the first research question ("*Why do the physical installation instructions of the commissioner's waste sensor needs to be added to the mobile application and how do they benefit the user?*") was based on the findings and was purely user driven. The old mobile application was designed to mostly function without the help of easy-access manuals and instructions. The key finding here was that the manuals needed to be easily accessible and light to read (**Picture 12**). Giving the manuals more visible role in the mobile application gave the user confidence and a possibility to glance through the manuals not only during the installation but also before the installation. The manuals would give the installer confidence and support when needed.

The answer to the second research question (*"How should the installation materials be designed and implemented to the new mobile application so that the user benefits from them as much as possible?"*) was also based on the findings. In the old application text based and video based solutions had been tested but both methods had not met the user needs. The installer needed to have the manuals available when performing the related action but also so that he or she could see them before starting the installation process. The manuals needed to be flexible but also univocal, as there were basically three points where the installer needed the help of manuals.

6.4 User Journey Map

As the research pointed out, the main issue with the old mobile application was lack of good user flow in the process. The old application had not been designed keeping the

end-user in mind and the lack of concrete field research affected the flow. When designing the user flow of the new application, the aim was to place oneself in the shoes of the user; what happens during the installation, what are the installation steps and which of them are obligatory and which additional, what is the installation situation like and what is the overall situation of the installer when considering his work, working hours, motivation, education.

As always, the design was limited by boundary conditions within which the design had to happen. In this case, the boundary conditions came from the sensor mapping to the system and from the data it needed:

User identification: The user must identify himself when using the application.

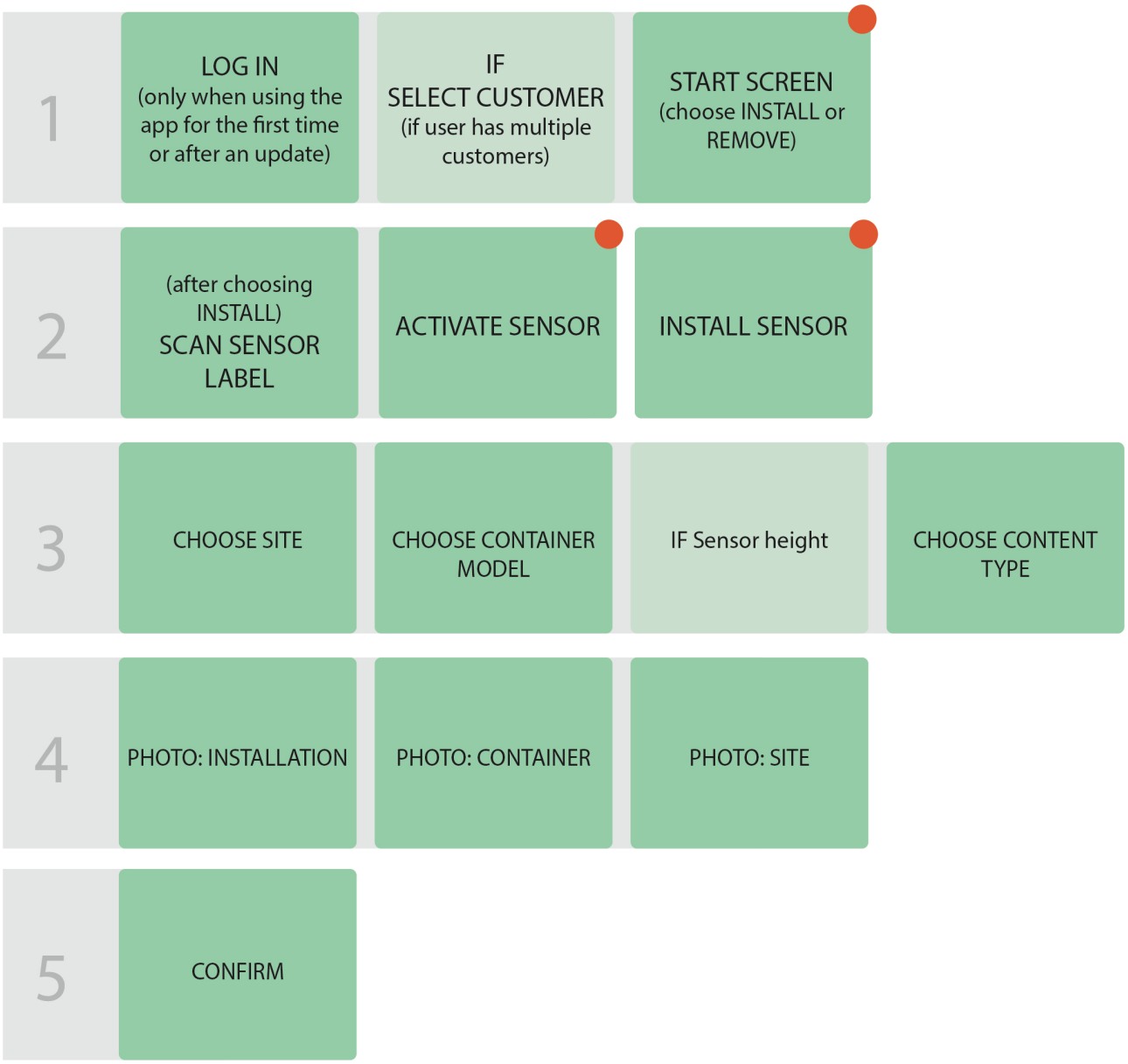
Activating sensor: The sensor must be activated prior to installation.

Site and container information: The sensor installation must contain information about the site (location), the container and the content type, and in some cases also the sensor height. Also, photos of the installation, container and site are obligatory information.

From the user's perspective, the flow was justifiable to start from the sensor, as it is the one thing around which everything in the physical installation process circles from the installer's perspective. Also from the installer's perspective it is justifiable to make the installer perform primarily those actions to which they are familiar with and only secondarily things with which the installer is not so familiar with. Thus, the installing process begins from activating the sensor and then mounting it. Physical installation is familiar to the installer and activation needs to happen prior to it.

Before those two actions, activation and mounting, are only user identification and customer select. Apart from the old mobile application, in the new application the site- and container-related matters come only after the installer has mounted the sensor.

Picture 9 described the flow broken into steps; step 1 is logging in, choosing the customer and selecting the action (install or remove). Step 2 is sensor activation and mounting, step 3 is mapping the sensor to the system, step 4 is identifying the installation and step 5 is confirmation.

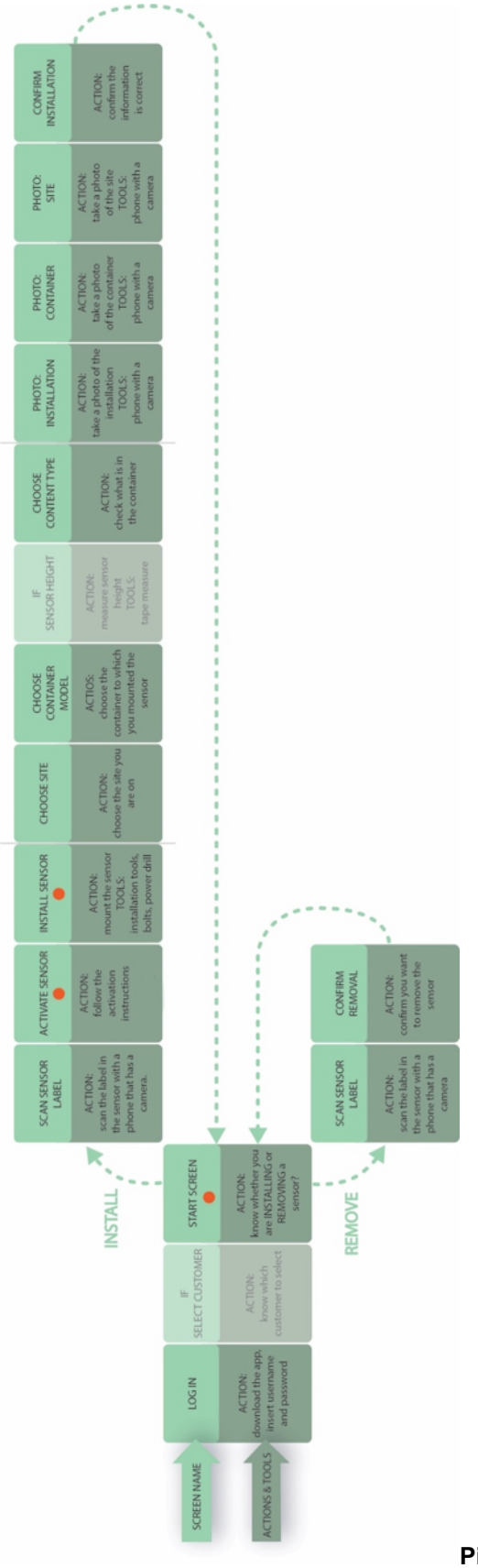


Picture 9: New mobile application flow divided into sections (Kangas 2017)

The red dots in **Picture 9** and **Picture 10** mark the spots when the user sees manuals. Basically, the change from the old mobile application is that the user has a chance to familiarize himself with the manuals beforehand and not only when he needs to perform activation or mount the sensor. The basic idea is that the manuals are visible to the user from the start screen, not only during the installation.

Picture 10 shows the two flows of the new mobile application. When the user logs in there are two or three screens depending on the customer case before the user sees the start screen, which is the main screen of the application. From the start screen the user can choose INSTALL or REMOVE flows, or log out, read manuals or change customer. The INSTALL flow has 10 or 11 steps depending on the container type, and differing from the old mobile application the new application's flow starts by activating and installing the sensor, only after which comes the site and container mapping. This is the biggest change from the old application. The old application's flow started by defining first the site and container spesifications, which was confusing for the installer. In the new mobile application the idea is that the installer uses an external method to locate the sites, after which he drives to them. On the site the installer's goal is to succesfully install the sensor, which supports the idea of starting the process from the sensor.

From the start screen the user can also choose REMOVE flow, which is shorter then the INSTALL frow having only two steps. Later if the commissioner wants to develop the application further, also the REPLACE flow can be added. The key feature in both flows is that they are looping and when the INSTALL flow has been finished, the user is taken back to the start screen.



Picture 10: Flows of the new application (Kangas 2017)

7 PROTOTYPING

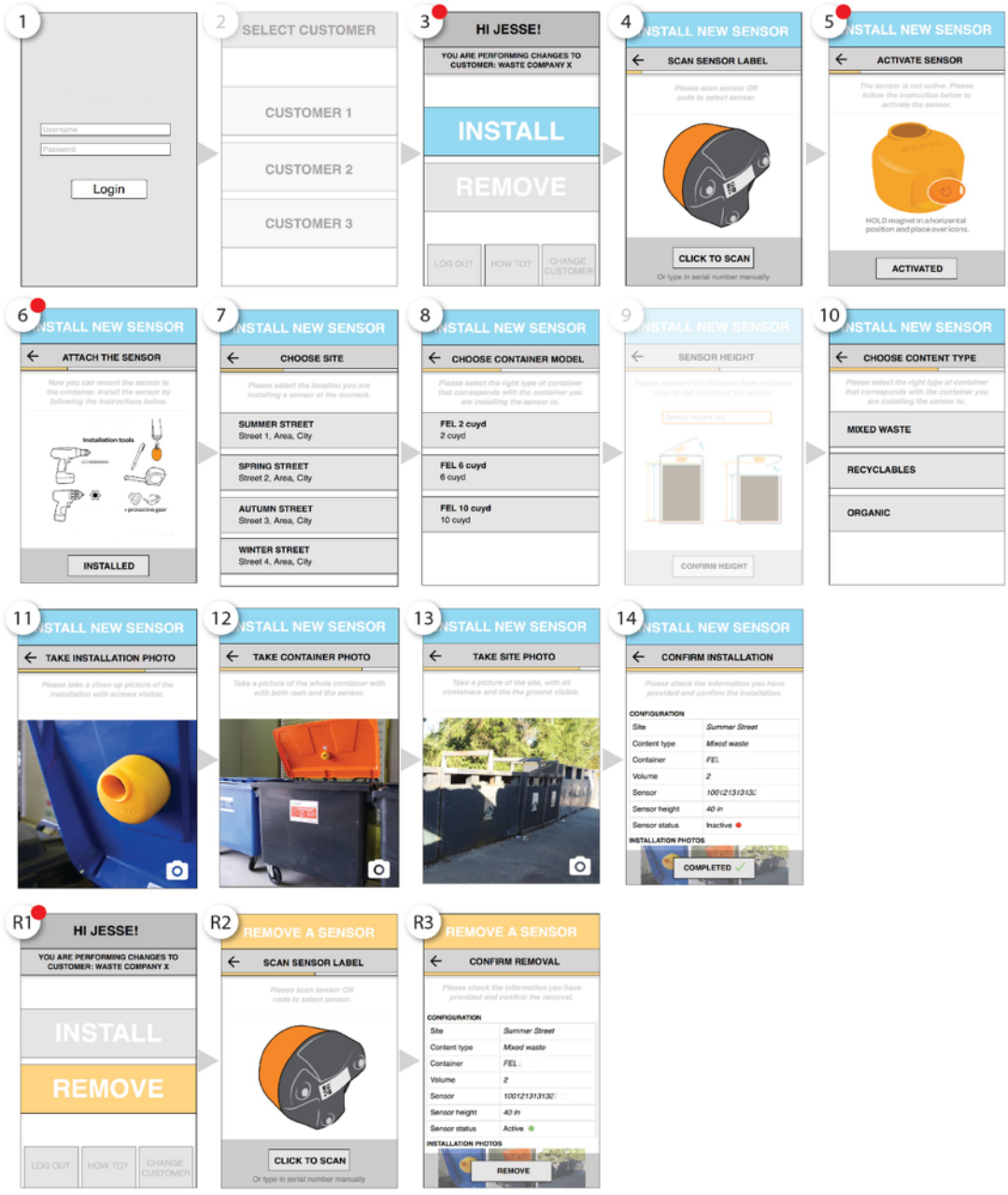
7.1 Agile Development

The agile development process was completed with an online clickable demo mock-up of the desired flow (**Picture 11**). The mock-up was tested with both commissioner employees and commissioner's customer representatives. The validations were completed via conference calls and face-to-face meetings. In the validation session the person responsible for the validation process first sent a link to the user, after which the user was asked to do a walk-through of the flow and comment his actions along the way. After the flow had been finished the person responsible for the validation process could ask the user some questions about the flow and how the user felt about the flow.

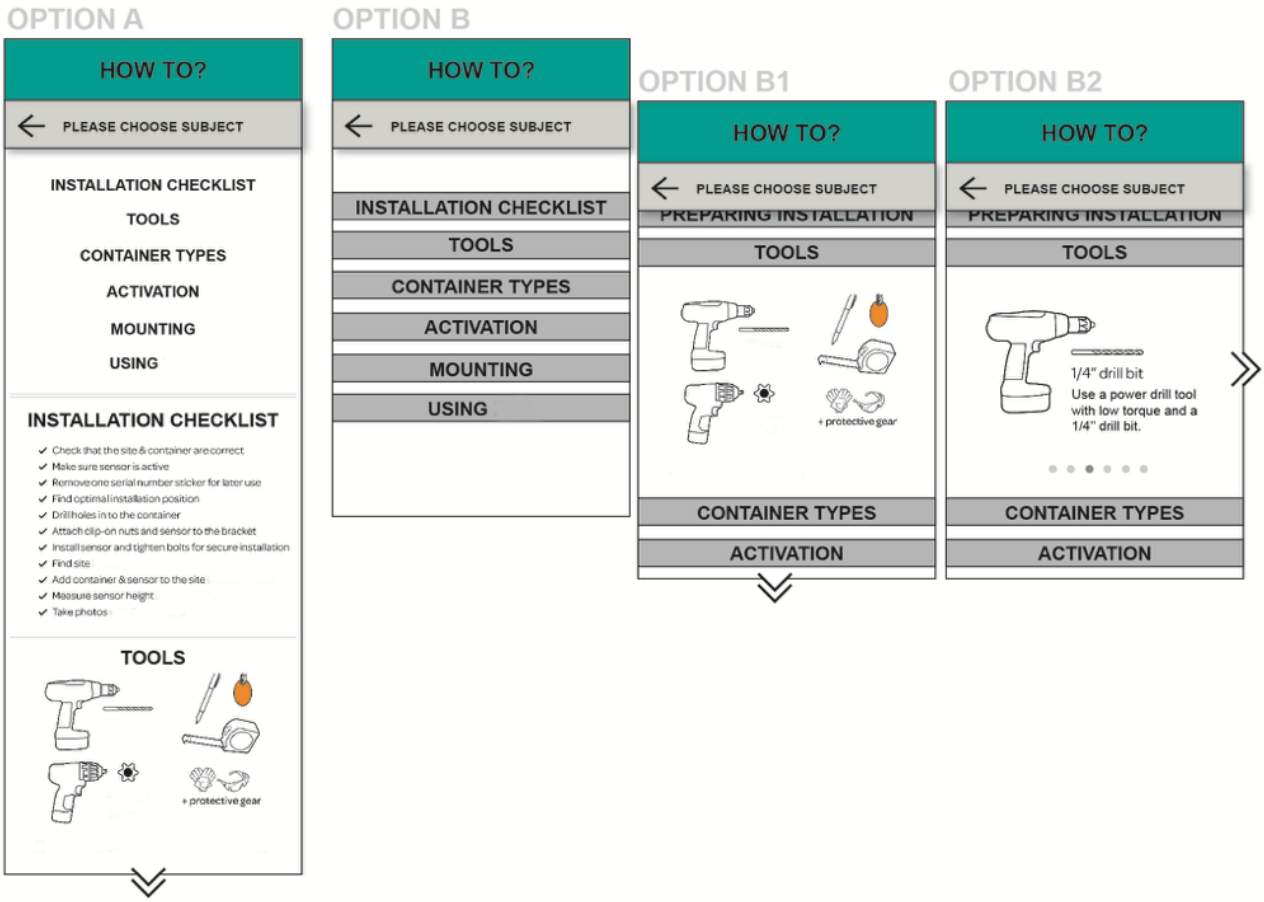
After validations, the mock-up was edited and the actual development process started. After validating the process flow, the ideation on how to add the manuals and guides as a part of the application was started so, that they would be easily accessible, easy to understand and use. There were three points where the manuals were accessible for the user: the start screen, the activation step and the mounting step. The idea was that in the start screen all the manuals would be available. Step 5 would have activation instructions available and step 6 mounting instructions available (**Picture 9**).

There were a few options how the manuals could be implemented to the application, which are shown in **Picture 12**. The first idea (*Option A*) was a list-type approach, the strength of which was the visibility of the manuals on the same screen without clicking buttons. The weakness of *Option A* was that it could be difficult to understand the overall picture and find a certain piece of information. The second idea (*Option B*) was a collapsible menu, the strength of which was the easy visibility of the headlines and overall installation process. The weakness of *Option B* was the number of clicks needed

to read through all the sections. For *Option B* two alternatives were ideated on how a single topic could be presented; *Option B1* would show just a static picture whereas *Option B2* would have a horizontally scrollable set of images. *Option B2* would also allow for more explanatory text next to the images, for example, the kind of power drill or torque is needed.



Picture 11: New mobile application flow (Install flow: 1-14, Remove flow: R1-R3). Red dots mark the points when manuals are available (Kangas 2017)



Picture 12: Visualization of ideas (Kangas 2017)

Another option was to have the manuals done with looping .gif style animations. This option was dismissed at least in the first version of the new application due to the timetable. In the future, it could be an option, but its usefulness should be tested with user validations, since for example video tutorials had not been given too high ratings previously.

Option B2 was chosen with the team based on its good information value and best understandability of the presented ideas. With the activation and mounting flows Option B2 could also be used with some modifications.

8 CONCLUSION

The goal was to understand the installation process and how the manuals should be implemented to the new mobile application. The main challenge of the project was to understand the overall picture of the installation process since it had not been properly charted within the commissioner company. There was scattered information of the different parts of the project, but nobody knew exactly the installation process completely, what phases it had and how they affected each other. Thus, the first thing for the author was to learn the process and its flows, which was conducted by internal interviews. The O3 interviews played a significant part in this and the outcome of them was the current installation flow chart. The brainstorming sessions and the workshop supported the findings from the O3's, and the information was proven correct with the external studies.

The process started with the O3 interviews approximately 1.5 years before the completion of the thesis, which is a long time in a start-up. During that time, many things changed internally and in customer relations and new and improved versions of the waste sensors were developed. Though it being inevitable that the waste sensor type, which acted as the basis for the thesis, will someday be eliminated, the process flow will remain more or less the same for a long time. This is because the installation process will be needed as long as there is a physical sensor which performs the data transfer. The process flow is the most valuable finding in the study and it is up to the commissioner how the company wishes to use the findings.

Overall the process proceeded smoothly, even though there were times when the capability to finish the thesis was questioned. The most difficult and time-consuming matter was to drive the process through with even energy levels and enthusiasm. The most educational part was when the research-based summary was completed, since that was a moment when it was easy to understand the meaning of experience design in user-based projects such as the thesis.

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A great big thank you belongs to the following teams and individuals:

The commissioner company, especially the HW and SW teams
TUAMK LSD15 teachers and fellow students
Pup, Vipe, Pöp & Nakki